

Assessing water use under MYFAs by county in GMDs 2 and 5

Kansas Dept of Agriculture-Division of Water Resources

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Under a Multi-Year Flex Account (MYFA), a water right holder can convert their water right into a five-year term permit that allows annual use to exceed authorized quantity in any given year, but limiting use to a five-year allocation¹. MYFAs were authorized by K.S.A. 82a-736 “*...to improve water management by enabling multi-year flexibility in the use of water authorized to be diverted under a groundwater water right, provided, that such flexibility neither impairs existing water rights, nor increases the total amount of water diverted, so that such flexibility has no long-term negative effect on the source of supply.*”

Prior to 2012, a 10% conservation factor against historical water use was required, and the program saw little use. KDA developed amendments to the program in 2012, which the Legislature adopted, to increase participation by removing the conservation requirement and allow for multiple ways to determine the 5-year allocation. As reported to the Legislature, the program saw significant expansion in use.

The Chief Engineer is required to annually report to the Legislature on the program’s implementation. As part of preparations for the 2020 report, DWR assessed how water use under MYFAs compares with pre-MYFA use by the same water rights to determine if the program was allowing expanded use under the water rights.

The Chief Engineer’s 2020 Report to the Kansas Legislature on MYFAs, posted online², contains an attached map of Kansas showing locations of active MYFAs permitted in each of years 2016-2019. Most MYFAs are located within the GMDs, mainly concentrated in two GMD2 counties (HV and SG) and seven GMD5 counties (BT, SF, PN, ED, KW, PR and RC). This analysis was limited to MYFAs within GMDs 2 and 5.

For each county in GMDs 2 and 5, , reported water use per acre (inches) for water right files currently enrolled in MYFAs was compared between the pre-MYFA period (2000-2009) and the MYFA period of 2012-18, when most MYFAs were active. In addition, water use was compiled for the remaining water files in each county as a control group. The two groups are compared to determine whether the MYFA-associated water use is distinguished by management differences from the remaining water use in the county, which is expected to vary primarily with climatic factors.

Water use variation with climatic factors

Irrigation pumping varies significantly from year to year in response to climate factors. In comparing pre-MYFA and MYFA periods to assess whether the MYFA program was allowing for expanded use of such

¹ KDA-DWR, Multi-Year Flex Accounts. <https://agriculture.ks.gov/divisions-programs/dwr/water-appropriation/multi-year-flex-accounts>

² Chief Engineer’s 2020 Report on MYFAs, https://agriculture.ks.gov/docs/default-source/dwr-water-appropriation-documents/2020_myfa_report.pdf?sfvrsn=89908ec1_0

water rights, it is first necessary to establish whether the periods are comparable in terms of these climate factors.

To interpret annual variation of groundwater irrigation use in GMDs 2 and 5, climatic factors were found that explain 82 and 89 percent of the variation, respectively, based on data for years 2000-2018. These climatic factors are reference ET summed over June-September and precipitation summed over May-September, using monthly PRISM data for temperature and precipitation, and the Hargreaves-Samani approximation of reference ET based on temperature³. Fig. 1 plots annual sums of these predictors for years 2000-2018, and averages over years 2000-2009 and 2012-2018. Average climatic conditions based on these factors are quite similar for the two periods. For 2000-2009, reference ET was 22.44 inches and precipitation was 17.06 inches; for 2012-2018, reference ET was 22.62 inches and precipitation was 17.88 inches. That is, the MYFA period was slightly warmer and wetter than the pre-MYFA period. Given the relatively low magnitude of these differences and the opposing influence on predicted pumping, it is assumed on average that the two periods would show similar magnitudes in pumping per irrigated acre.

Water use variation

Groundwater irrigation pumping and irrigated area in GMDs 2 and 5 were summarized by county in Excel. Table 1 compares groundwater irrigation water use (in/yr) at pds associated with MYFAs against remaining pds in each of 11 counties for periods 2000-2009 (pre-MYFA) and 2012-2018 (MYFA period). The left-hand side of Table 1a summarizes average water use by rights associated with MYFAs for 2000-2009 (a) and for 2012-2018 (b), and the difference between the two periods ($b - a$). The right-hand side of Table 1a summarizes remaining water use in the county for 2000-2009 (a), 2012-2018 (b), and the difference ($b - a$). Negative differences are indicated by red type with parentheses.

Table 1b lists a second comparison of the numbers in Table 1a: the difference in use (inches) between MYFAs and the remaining rights in each county for the pre-MYFA years 2000-2009 and for 2012-2018. Table 1b also lists the number of points of diversion in each county associated with MYFAs and with remaining rights in each county. The last two rows of Tables 1a and 1b are corresponding numbers for all of GMDs 5 and 2, except that Reno County, which straddles both GMDs, was excluded. Re-running the WRIS query with a GMD identifier in the results would allow including Reno in the summaries for GMDs 5 and 2.

Table 1 averages are based on average groundwater irrigation use (acre-feet/year, Table 2) and average groundwater irrigated area (acres, Table 3). Tables 2 and 3 are based on data queried from WRIS and summarized by county. The last two rows of Tables 2 and 3 are sums over all counties in GMDs 5 and 2 excluding Reno, as for Table 1. The organization of Tables 2 and 3 is similar to that of Table 1, but differences between time periods are shown as fractions of water use or irrigated area in the first period, i.e. $(b - a)/a$.

Figs. 2-12 plot annual groundwater irrigation use (inches) for both MYFA-associated pds and all other pds for years 2000-2018 in each of the 11 counties listed in Table 1. The figures appear in the order

³ Hargreaves, George H. and Zohrab A. Samani, 1985. Reference crop evapotranspiration from temperature. *Applied Engineering in Agriculture*. 1(2): 96-99. <https://doi.org/10.13031/2013.26773>

listed in Table 1, and the averages listed in Table 1 for periods 2000-2009 and 2012-2018 are superimposed on these graphs (dashed lines) for the two groups of pds.

Discussion

Differences in reported water use by MYFAs between the two averaging periods 2000-2009 and 2012-2018 may be explained by either climatic effects or management differences due to the MYFAs, or both. Because climatic conditions for the two periods were found to be very similar, pumping in response to climate conditions would also be expected to be similar for the two periods. Comparison of pumping per unit area by the MYFA and non-MYFA groups of pds in each county provides an additional tool to evaluate MYFA management effects.

In reviewing Table 2 and Figures 2-12, we find that water use by MYFA-associated files tends to follow that of non-MYFA files, and we see little evidence of expanded use under MYFAs when compared to pre-MYFA use, with a few counties showing reduction in use during the MYFA period.

T. 1a. Reported irrigation groundwater use (in/yr) by county averaged over years 2001-2009 (pre-MYFA years) and 2012-2018 (MYFA years) for MYFA-associated rights in county (left-hand side) and for remaining rights in county (right-hand side).

Irrigation for pds associated with MYFAs						all remaining irrigation water use			
County		Co.	2000-2009	2012-2018	change (in)	Co.	2000-2009	2012-2018	difference
name	GMD	abbr.	a	b	b - a	abbr.	a	b	b - a (in)
Pawnee	5	PN	10.93	10.13	(0.81)	PN	11.63	11.06	(0.57)
Edwards	5	ED	13.76	12.87	(0.89)	ED	13.69	13.15	(0.54)
Kiowa	5	KW	14.21	13.05	(1.16)	KW	14.44	14.08	(0.37)
Barton	5	BT	12.24	11.96	(0.28)	BT	11.32	11.22	(0.10)
Stafford	5	SF	13.46	12.49	(0.97)	SF	12.74	12.63	(0.11)
Pratt	5	PR	13.25	12.09	(1.16)	PR	12.93	12.51	(0.42)
Rice	5	RC	10.77	10.78	0.00	RC	11.59	10.73	(0.86)
Reno	2,5	RN	14.18	12.27	(1.90)	RN	11.48	10.82	(0.66)
McPherson	2	MP	9.18	9.44	0.26	MP	10.12	9.15	(0.97)
Harvey	2	HV	9.34	8.31	(1.02)	HV	10.83	9.26	(1.57)
Sedgwick	2	SG	9.54	10.17	0.63	SG	10.71	9.28	(1.43)
GMD	5		12.90	12.07	(0.83)	SG	12.81	12.42	(0.39)
GMD	2		9.34	8.94	(0.39)	SG	10.60	9.21	(1.39)

T. 1b. Differences in average use (in/yr) for MYFA-associated water rights compared to remaining rights in each county for pre-MYFA years 2000-2009 and 2012-2018.

Difference in use (MYFAs - remaining rights, in.)					MYFA-	all
County		Co.	MYFA - rep.	MYFA - rep.	associated	remaining
name	GMD	abbr.	2000-2009	2012-2018	pds	pds
Pawnee	5	PN	(0.69)	(0.93)	89	981
Edwards	5	ED	0.07	(0.28)	121	1082
Kiowa	5	KW	(0.24)	(1.03)	85	435
Barton	5	BT	0.92	0.73	46	529
Stafford	5	SF	0.72	(0.15)	84	869
Pratt	5	PR	0.32	(0.42)	85	802
Rice	5	RC	(0.81)	0.05	50	363
Reno	2,5	RN	2.69	1.45	70	971
McPherson	2	MP	(0.95)	0.29	38	348
Harvey	2	HV	(1.50)	(0.94)	81	494
Sedgwick	2	SG	(1.17)	0.89	36	460
GMD	5		0.09	(0.35)	560	5061
GMD	2		(1.26)	(0.27)	155	1302

T. 2. Reported irrigation groundwater use (ac-ft/yr) by county averaged over years 2001-2009 (pre-MYFA years) and 2012-2018 (MYFA years) for MYFA-associated rights in county (left-hand side) and for remaining rights in county (right-hand side).

		water use for rights associated with MYFAs (af)				remaining irrigation water use (af)			
County		Co.	2000-2009	2012-2018	fract. change	Co.	2000-2009	2012-2018	fract. change
name	GMD	abbr.	a	b	(b - a) / a	abbr.	a	b	(b - a) / a
Pawnee	5	PN	2,114	1,877	(0.11)	PN	69,556	65,533	(0.06)
Edwards	5	ED	3,743	3,541	(0.05)	ED	109,507	102,859	(0.06)
Kiowa	5	KW	3,155	2,848	(0.10)	KW	55,744	54,779	(0.02)
Barton	5	BT	976	896	(0.08)	BT	33,769	32,920	(0.03)
Stafford	5	SF	1,828	1,796	(0.02)	SF	85,775	86,178	0.00
Pratt	5	PR	2,414	2,292	(0.05)	PR	88,264	86,946	(0.01)
Rice	5	RC	1,123	1,138	0.01	RC	18,958	16,853	(0.11)
Reno	2,5	RN	976	937	(0.04)	RN	46,552	49,824	0.07
McPherson	2	MP	604	593	(0.02)	MP	22,284	21,145	(0.05)
Harvey	2	HV	1,456	1,344	(0.08)	HV	28,010	25,061	(0.11)
Sedgwick	2	SG	573	597	0.04	SG	25,482	22,110	(0.13)
GMD	5		15,352	14,387	(0.06)		461,573	446,068	(0.03)
GMD	2		2,633	2,534	(0.04)		75,776	68,317	(0.10)

T. 3. Reported irrigated area (acres) by county averaged over years 2001-2009 (pre-MYFA years) and 2012-2018 (MYFA years) MYFA-associated rights in county (left-hand side) and for remaining rights in county (right-hand side).

		Irrigated area (ac) for rights associated with MYFAs				All remaining irrigated area (acres)			
County		Co.	2000-2009	2012-2018	fract. change	Co.	2000-2009	2012-2018	fract. change
name	GMD	abbr.	a	b	(b - a) / a	abbr.	a	b	(b - a) / a
Pawnee	5	PN	2,322	2,222	(0.04)	PN	71,633	70,947	(0.01)
Edwards	5	ED	3,264	3,302	0.01	ED	96,005	93,790	(0.02)
Kiowa	5	KW	2,665	2,620	(0.02)	KW	46,265	46,502	0.01
Barton	5	BT	956	899	(0.06)	BT	35,863	35,264	(0.02)
Stafford	5	SF	1,629	1,724	0.06	SF	80,884	81,831	0.01
Pratt	5	PR	2,190	2,278	0.04	PR	81,990	83,348	0.02
Rice	5	RC	1,244	1,267	0.02	RC	19,551	18,851	(0.04)
Reno	2,5	RN	834	915	0.10	RN	48,838	55,378	0.13
McPherson	2	MP	789	753	(0.05)	MP	26,345	27,756	0.05
Harvey	2	HV	1,885	1,953	0.04	HV	30,756	32,273	0.05
Sedgwick	2	SG	725	701	(0.03)	SG	28,463	28,661	0.01
GMD	5		14,269	14,312	0.00	SG	432,190	430,534	(0.00)
GMD	2		3,399	3,407	0.00	SG	85,564	88,690	0.04

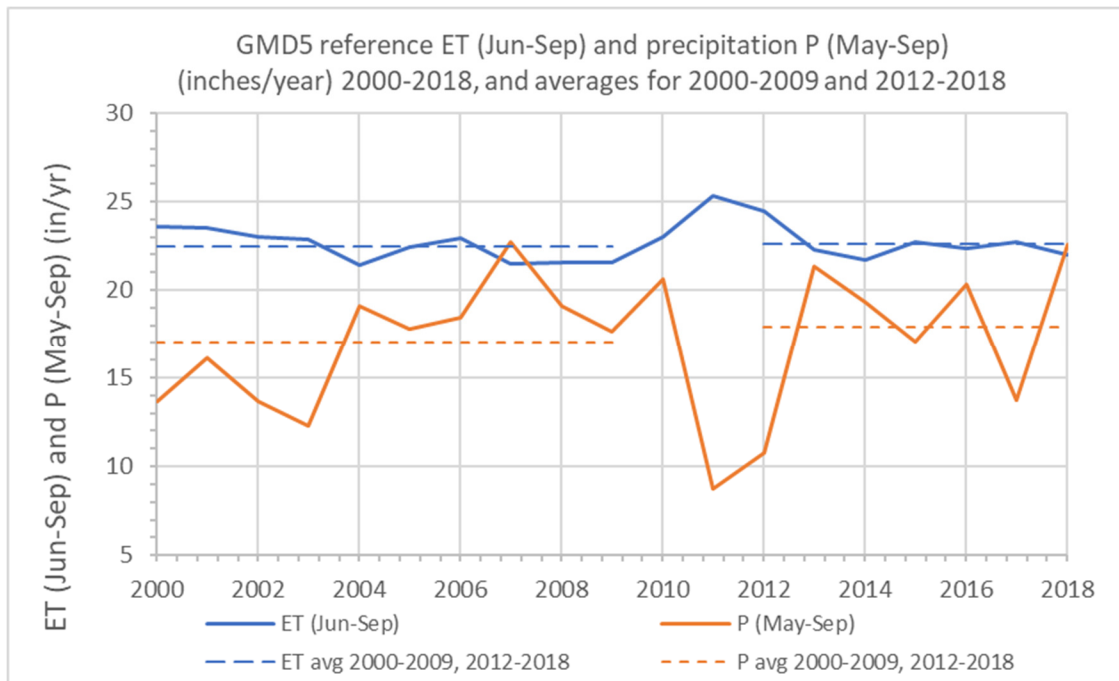


Fig. 1. Annual sums of reference ET (June-September) and precipitation (May-September) spatially averaged over GMD 5. Also shown are averages over periods 2000-2009 and 2012-2018. These climatic variables explain 89 percent of annual water use variation in GMD 5 for 2000-2018. The same pair of climatic variables explain 83 percent of annual water use variation in GMD 5 for 2000-2018.

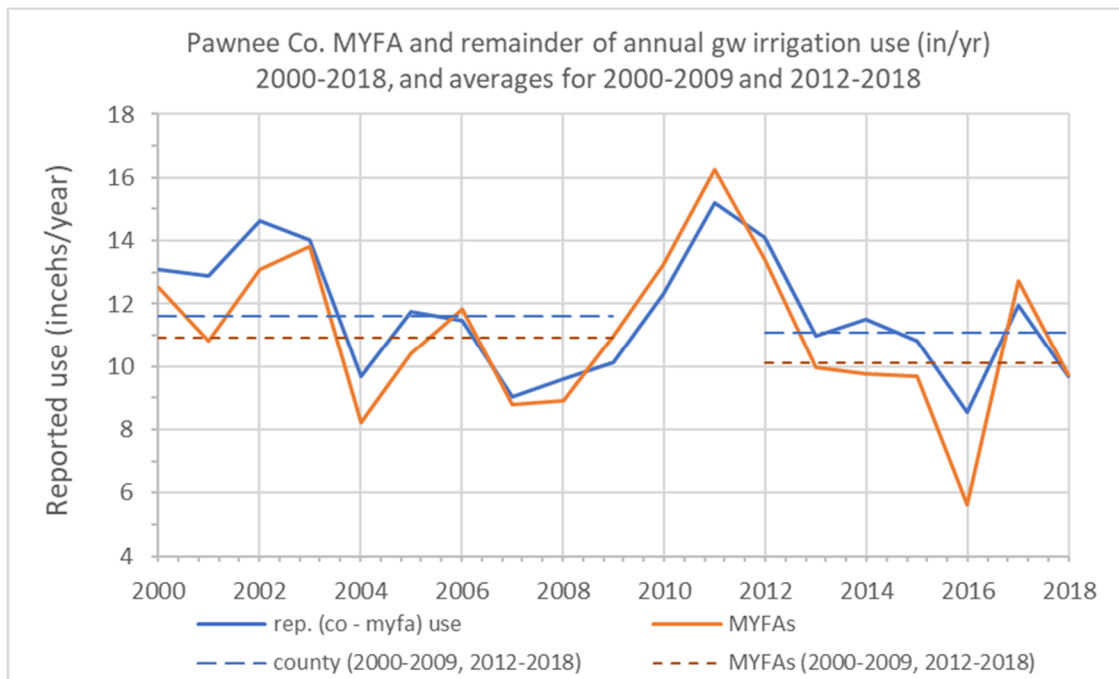


Fig. 2. Pawnee Co. comparison of water use per unit area (inches) at points of diversion associated with MYFAs (orange line) vs. annual water use for all other pds in the county (blue line). Corresponding averages over years 2000-2009 and 2012-2018 are also plotted for both groups (dashed lines).

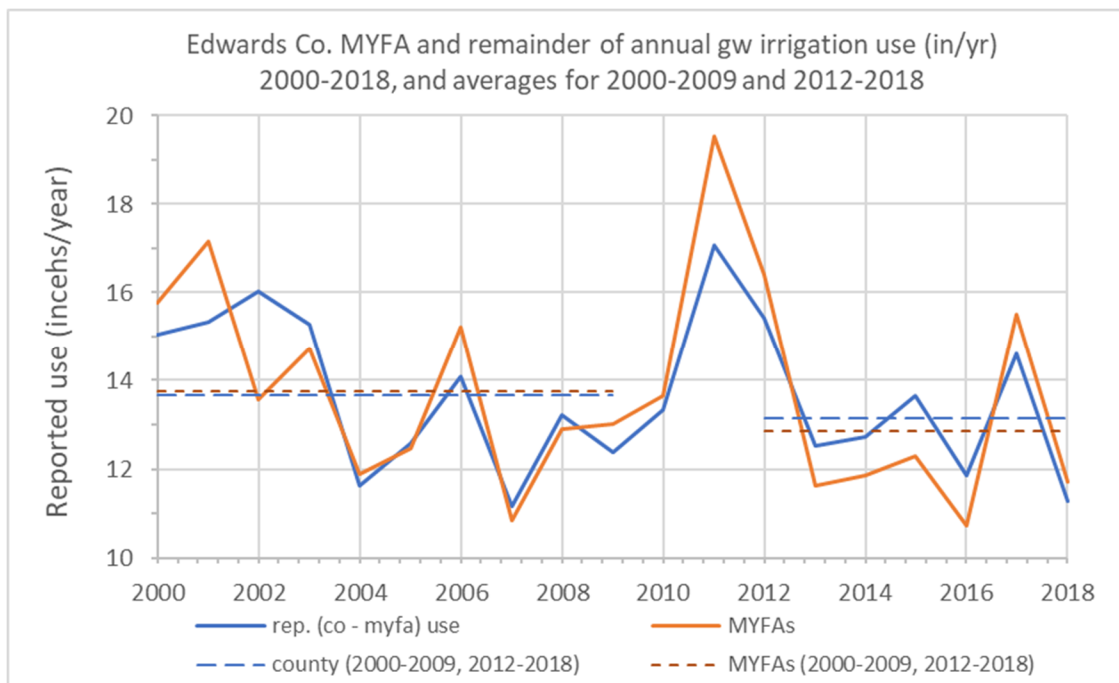


Fig. 3. Edwards Co. comparison as described in Fig. 2 caption for Pawnee Co.

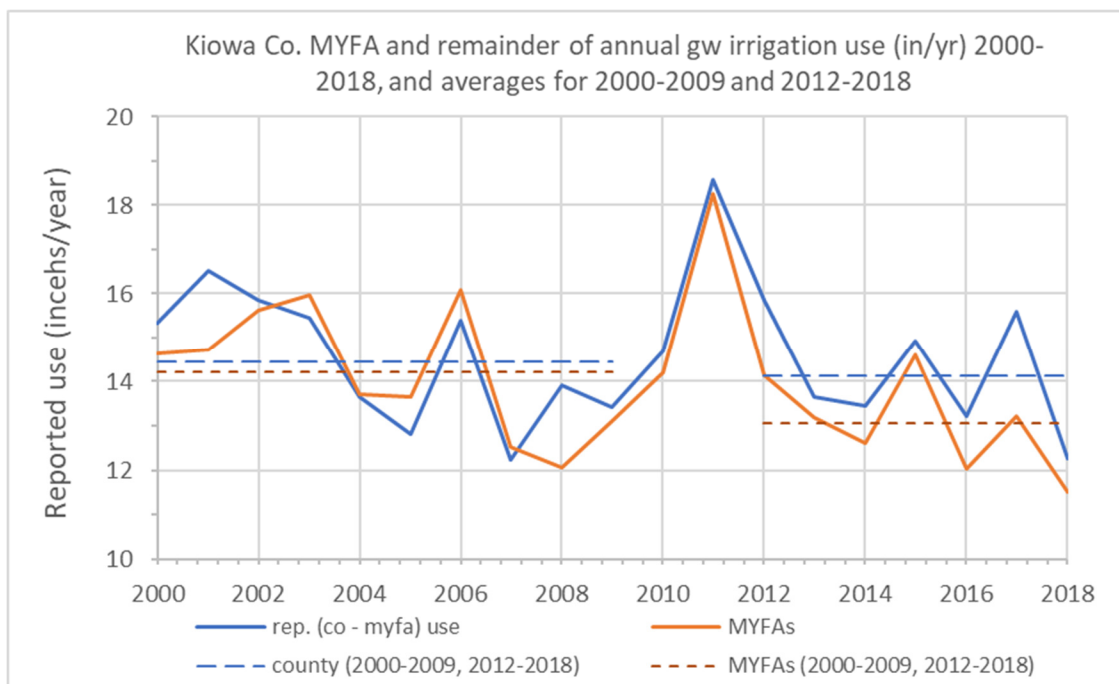


Fig. 4. Kiowa Co. comparison as described in Fig. 2 caption for Pawnee Co.

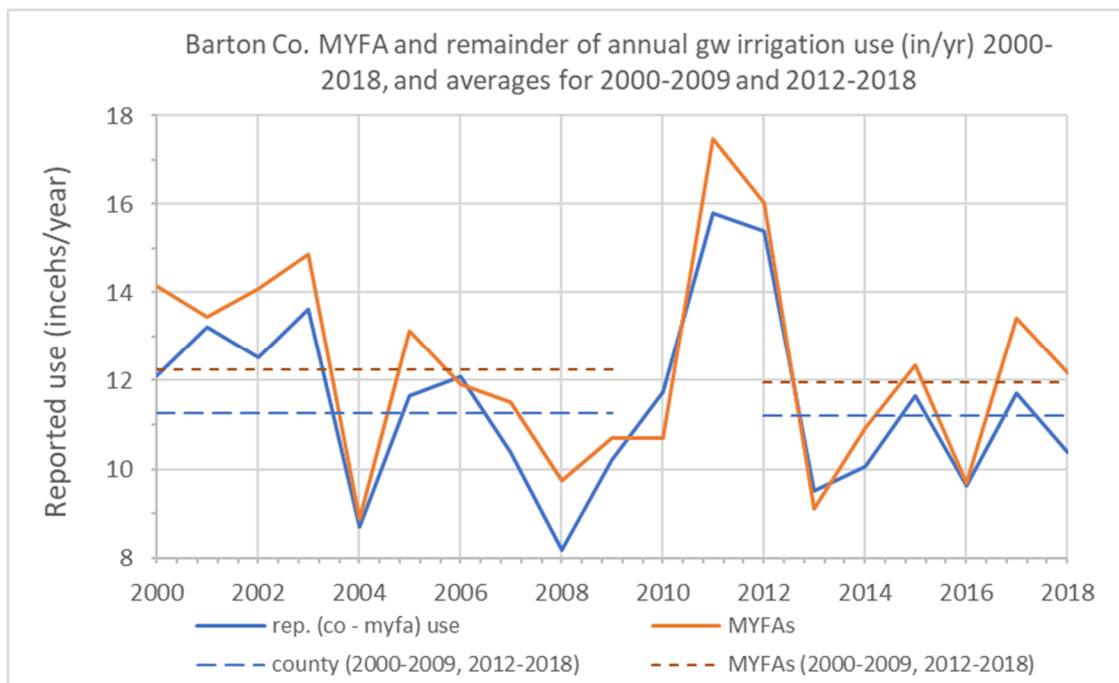


Fig. 5. Barton Co. comparison as described in Fig. 2 caption for Pawnee Co.

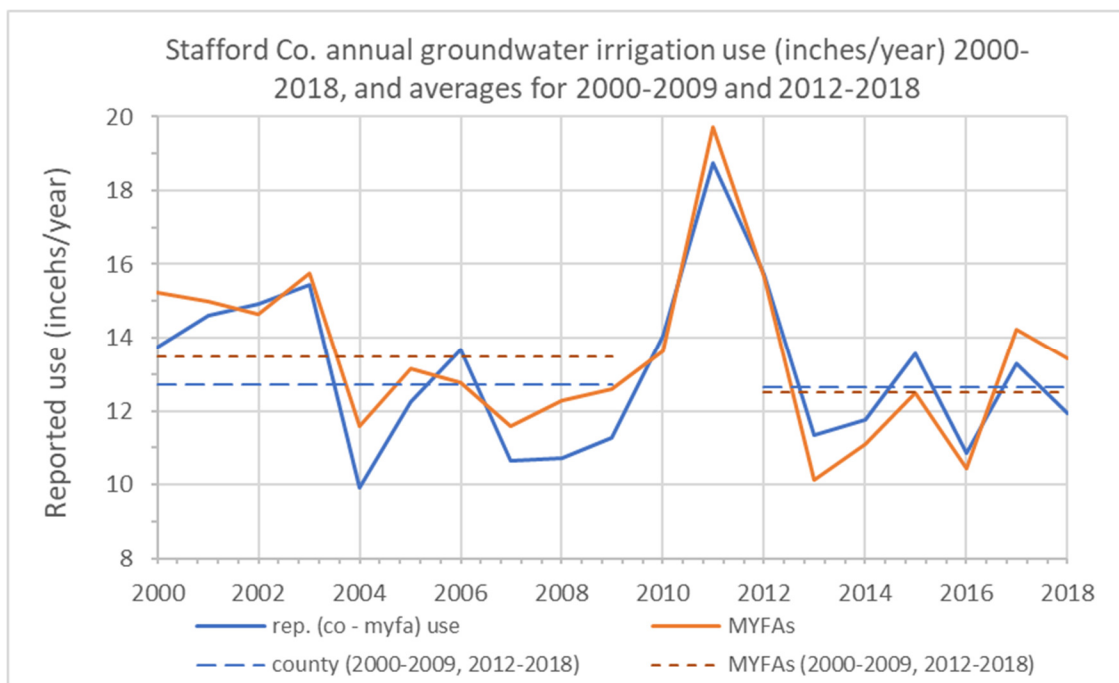


Fig. 6. Stafford Co. comparison as described in Fig. 2 caption for Pawnee Co.

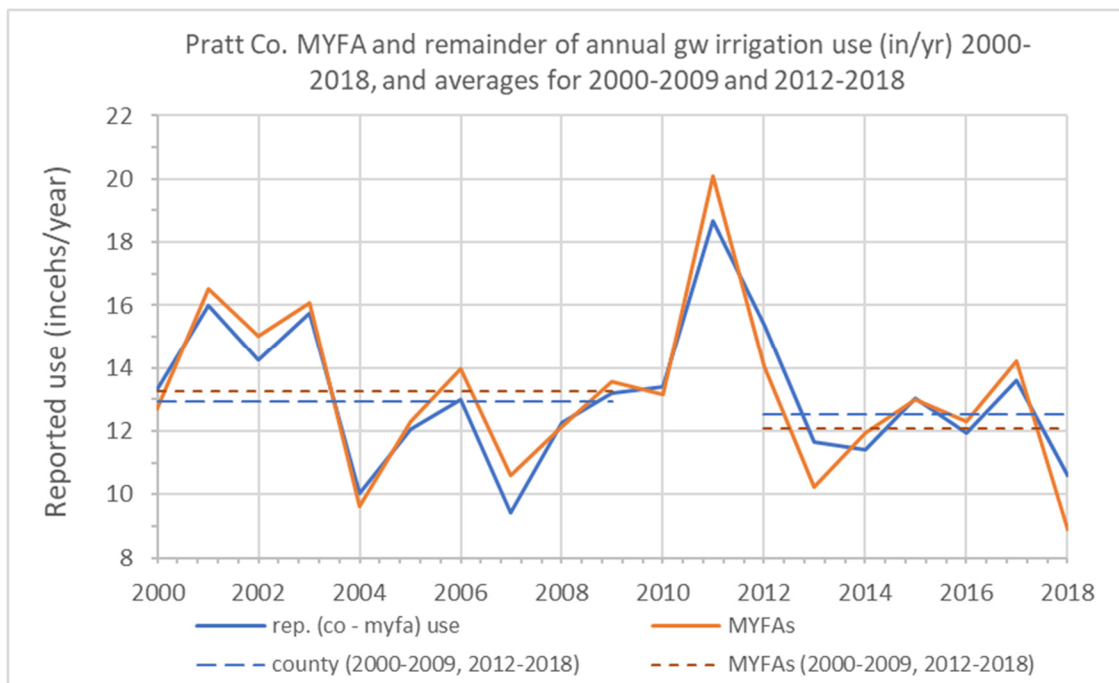


Fig. 7. Pratt Co. comparison as described in Fig. 2 caption for Pawnee Co.

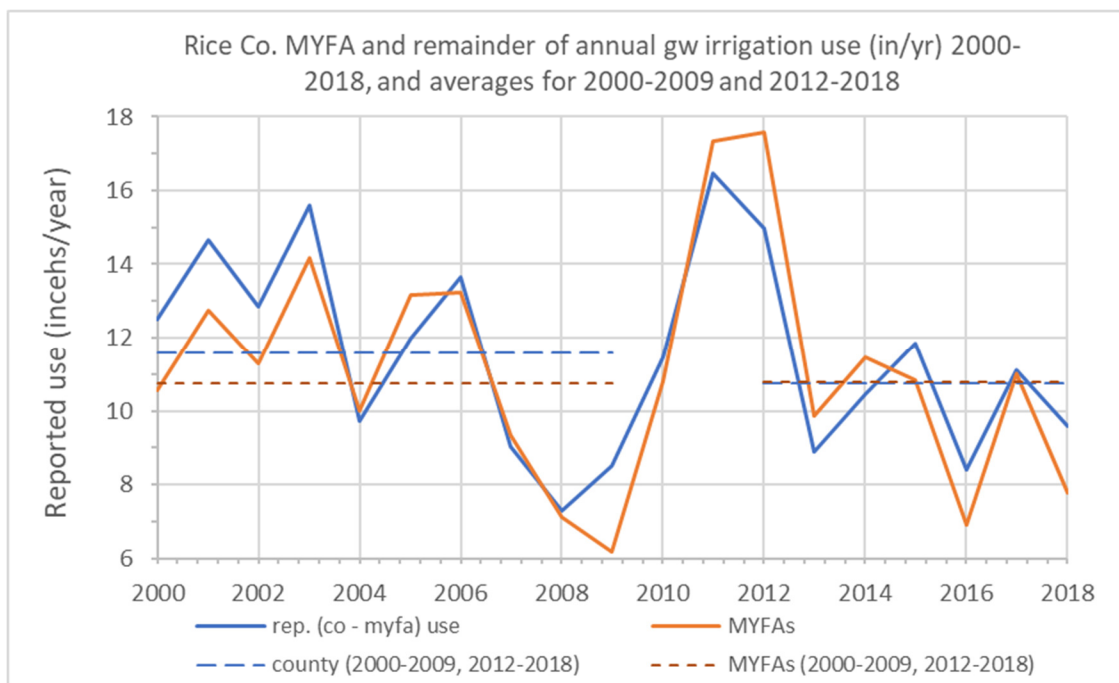


Fig. 8. Rice Co. comparison as described in Fig. 2 caption for Pawnee Co.

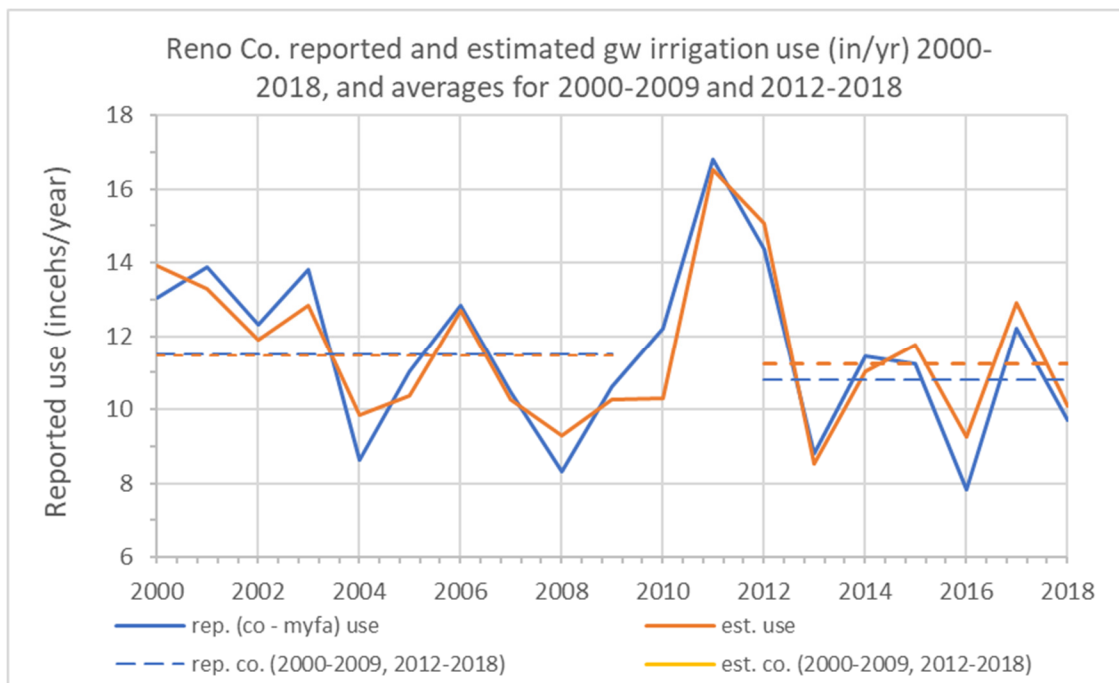


Fig. 9. Reno Co. comparison as described in Fig. 2 caption for Pawnee Co.

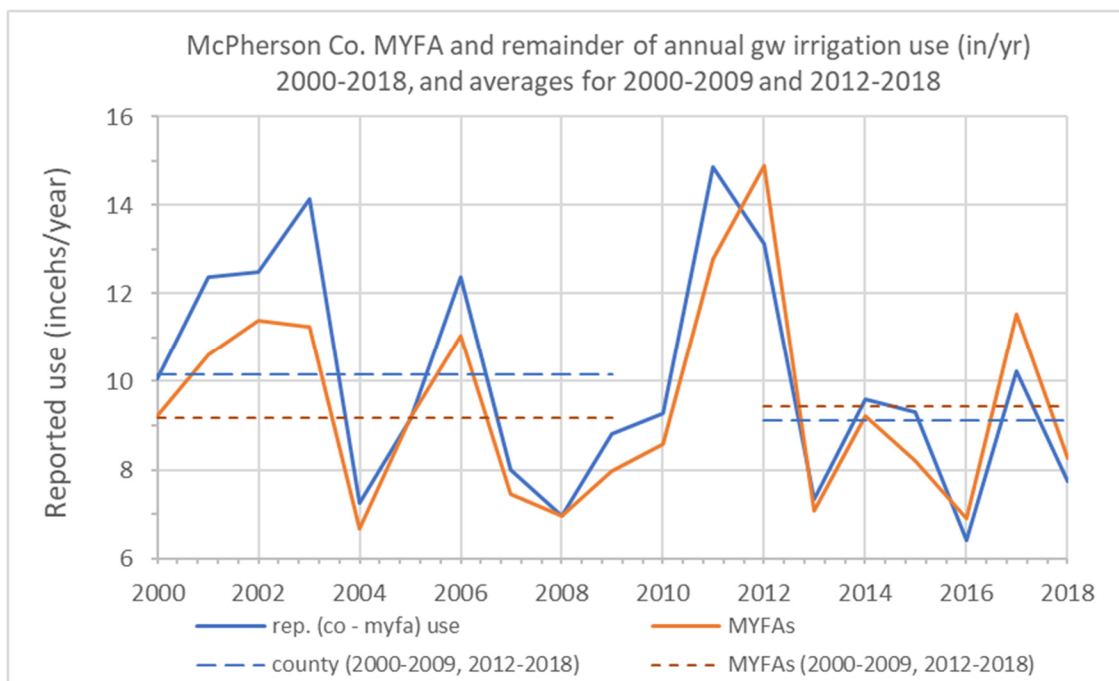


Fig. 10. McPherson Co. comparison as described in Fig. 2 caption for Pawnee Co.

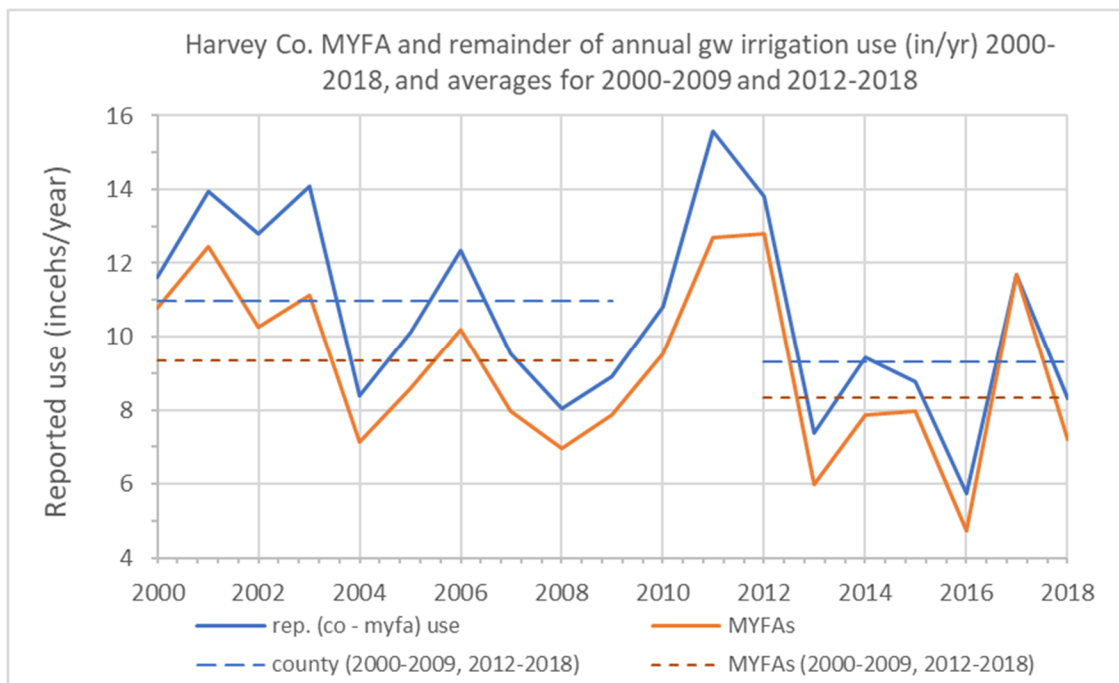


Fig. 11. Harvey Co. comparison as described in Fig. 2 caption for Pawnee Co.

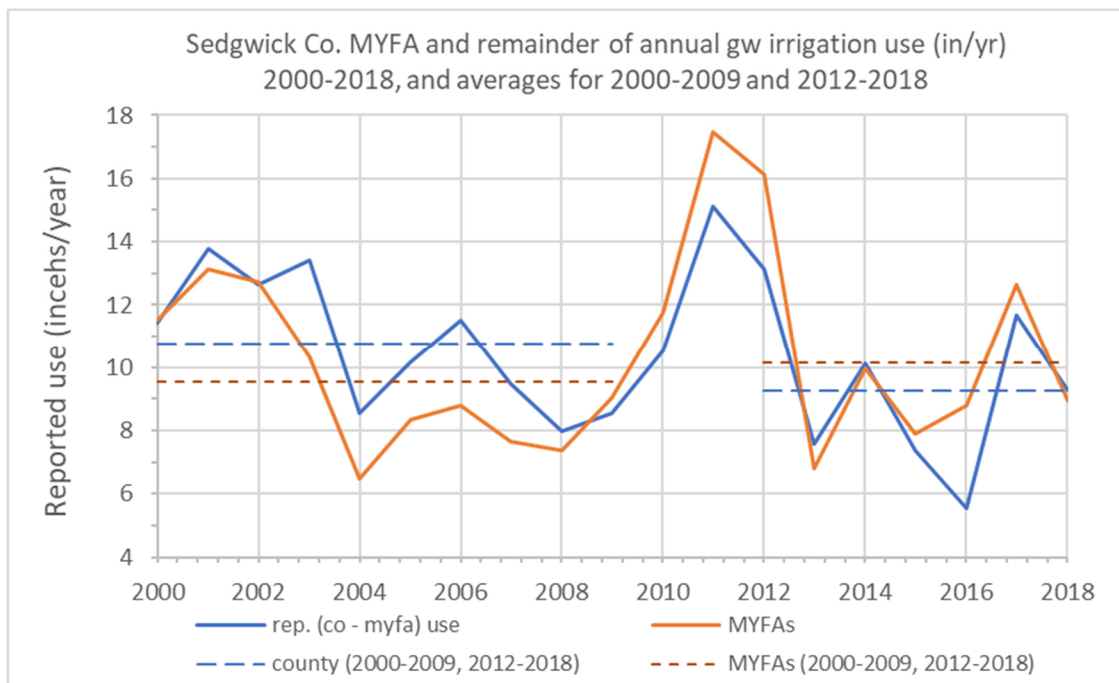


Fig. 12. Sedgwick Co. comparison as described in Fig. 2 caption for Pawnee Co.